An Ontario Service Centre (PCA) Standardized Protocol for Monitoring Landscape Dynamics

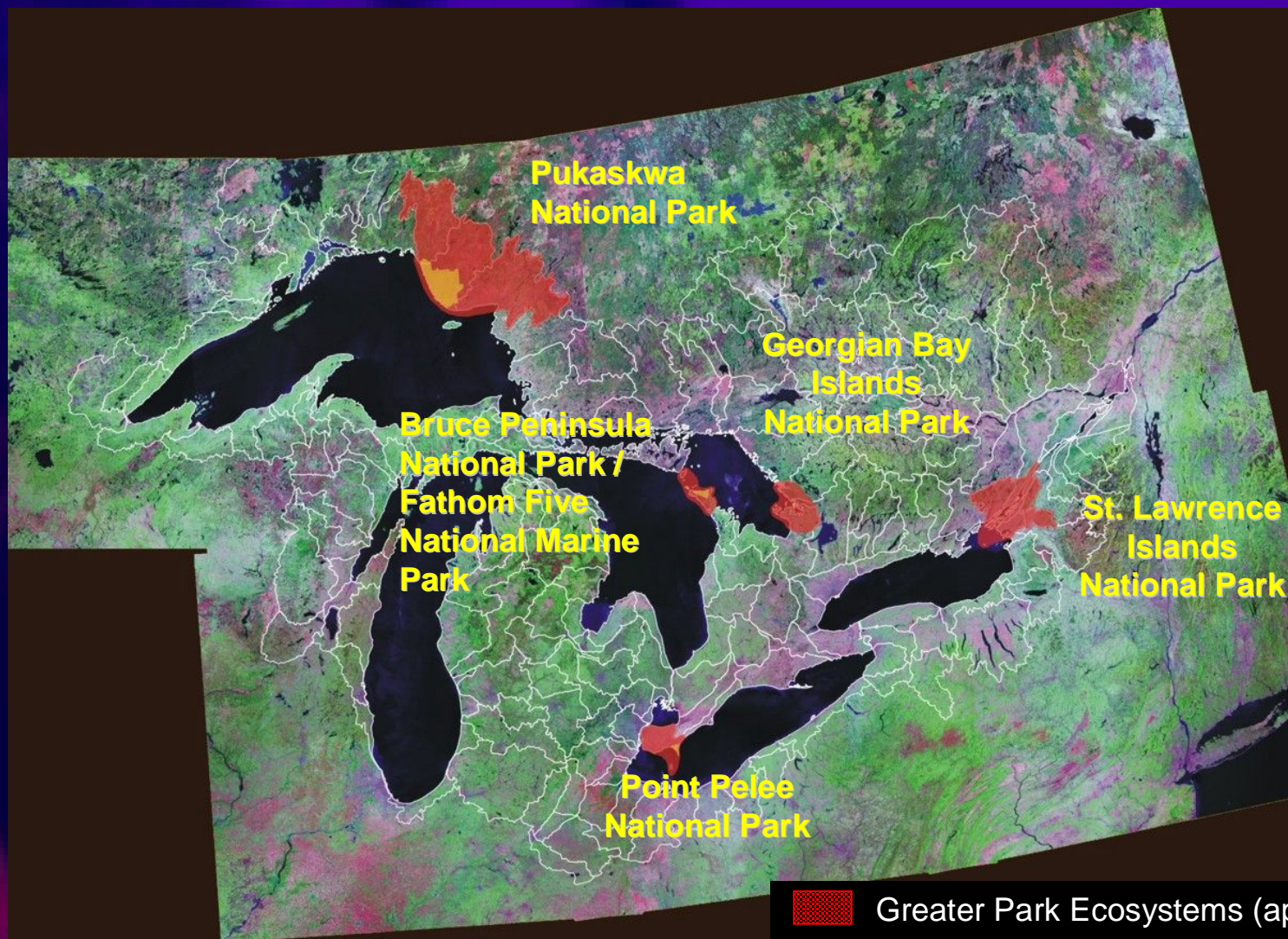## Parks Canada Agency - Ontario Service Centre

Justin Quirouette
justin.quirouette@pc.gc.ca

&

Paul Zorn
paul.zorn@pc.gc.ca

Objective 2: Landscape Dynamics

1. Key *Approaches* for Monitoring Landscape Dynamics Developed by OSC

2. Key *Factors* Addressed in Developing These Approaches

Context: National Parks & Greater Park Ecosystems (GPE)

Pukaskwa
National Park

Georgian Bay
Islands
National Park

Bruce Peninsula
National Park /
Fathom Five
National Marine
Park

St. Lawrence
Islands
National Park

Point Pelee
National Park

Greater Park Ecosystems (approximate)

Background:

- **Timeline**

  - **2000: ConBio (Conservation Biology) Committee**

  - **2002: Presentation of Draft Methods**

  - **2003: Presentation at SAMPAA 5**

  - **2003: Carleton U.: GLEGL (Fahrig, Tischendorf, Jaeger, Lindsay (Freemark))**

  - **2004: Initial Results in SOPR**
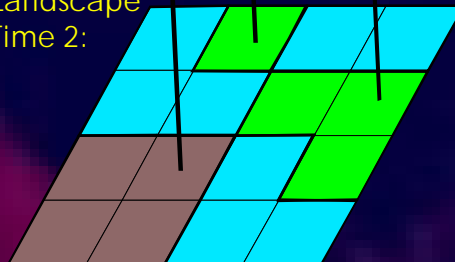
Three Components of LD Monitoring Protocol:

1. **Change Detection:**
   - **Magnitude & Direction**
   - **Forecasting Change (Markov Models)**
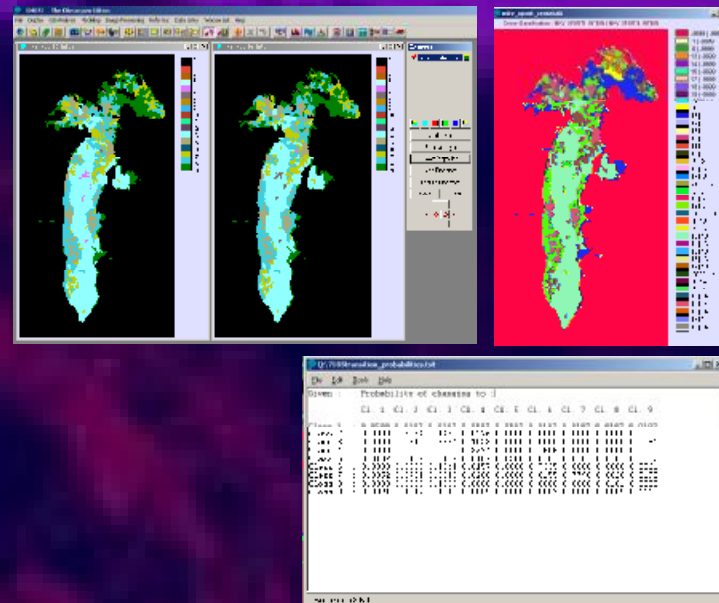

Landscape Time 1:
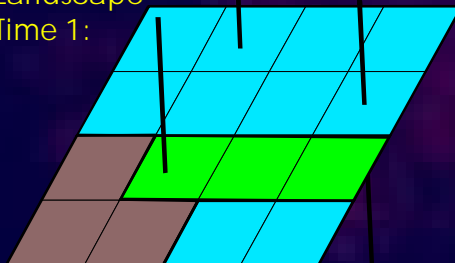
Landscape Time 2:

Magnitude of Change:
Class 1 Area = 62.50% to 50.00%
Class 2 Area = 18.75% to 25.00%
Class 1 Area = 18.75% to 25.00%

Direction of Change:

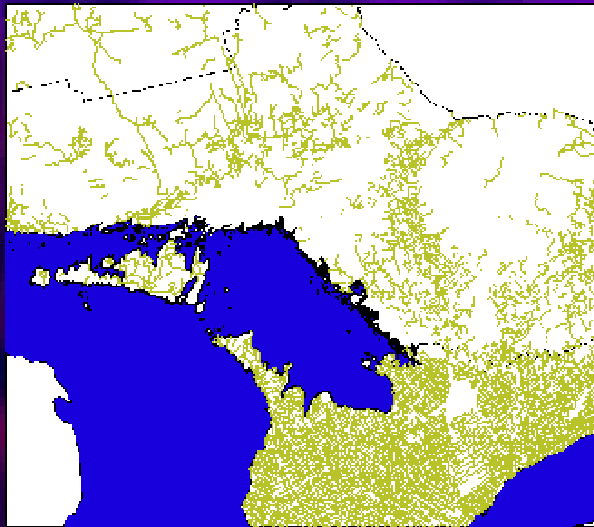|	Class1	Class2	Class3
Class1	7	0	3
Class2	0	3	0
Class3	1	1	2

Three Components of LD Monitoring Protocol:

2. **Human Footprint:**
   - **Roads, Other**

3. **Fragmentation:**

Fragmentation:

- **Definition:**

    "The breaking up of a habitat or land type into smaller parcels … It is implicit that the pieces are somewhat-widely and usually unevenly separated." **Forman, 1995**

- **Components:**

    LOSS
    COMPOSITION (#, Size)
    SHAPE
    CONFIGURATION

Fragmentation Key Factors (why):

- **Scale**

- **Input Data**

- **Quantitative Issues**

- **Ecological Interpretability**

- **Interpreting Trends**

Fragmentation Key Factors (how):

Scale

- **Extent: Fixed study areas (park & GPE).**
  - Specific, defined landscapes.
- **Grain: Fixed data grain of 25m (Landsat).**

Input Data (consistency over time)

- **Classification accuracy**
- **Classification methods (pixel vs. object based)**
- **Classification algorithms**
- **Orthorectification**
- **Metadata**

Fragmentation Key Factors (how) cont'd:

Quantitative Issues

- **Issues related to communication and ease of interpretation (eg, ranges, dimensions).**
- **Multicollinearity.**
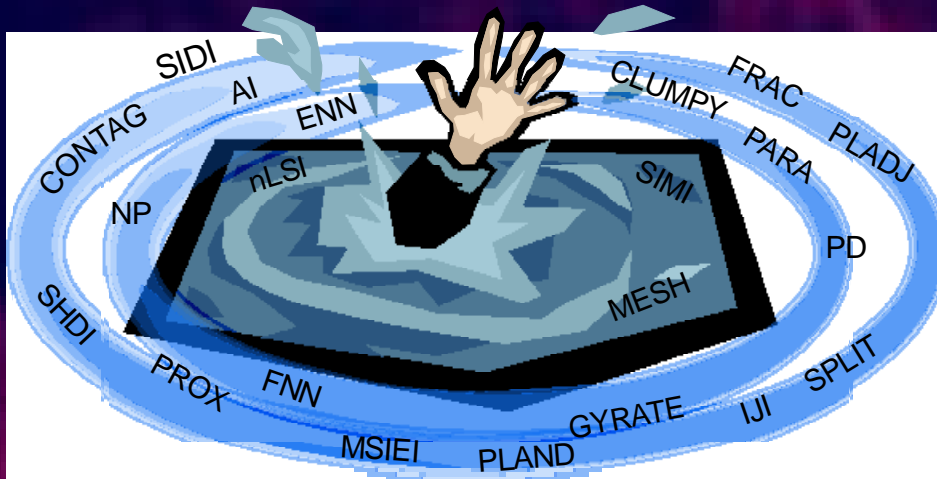
Rotated Component Matrix[a]

|	Component		
	1	2	3
AREA	**.976**		
PERIM	**.913**	.376	
GYRATE	**.894**	.421	
SHAPE	.488	**.812**	
FRAC	.190	**.941**	
CIRCLE		**.831**	-.166
CONTIG	.124	**.670**	.399
CORE	**.951**		
NCORE	**.518**	.550	.167
CAI	**.615**	.287	.476
PROX			**.879**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
   a. Rotation converged in 4 iterations.

- **Standardize?**
  - **PCA**
  - **Coefficients of Congruence**

Fragmentation Key Factors (how) cont'd:

**Ecological
Interpretability**
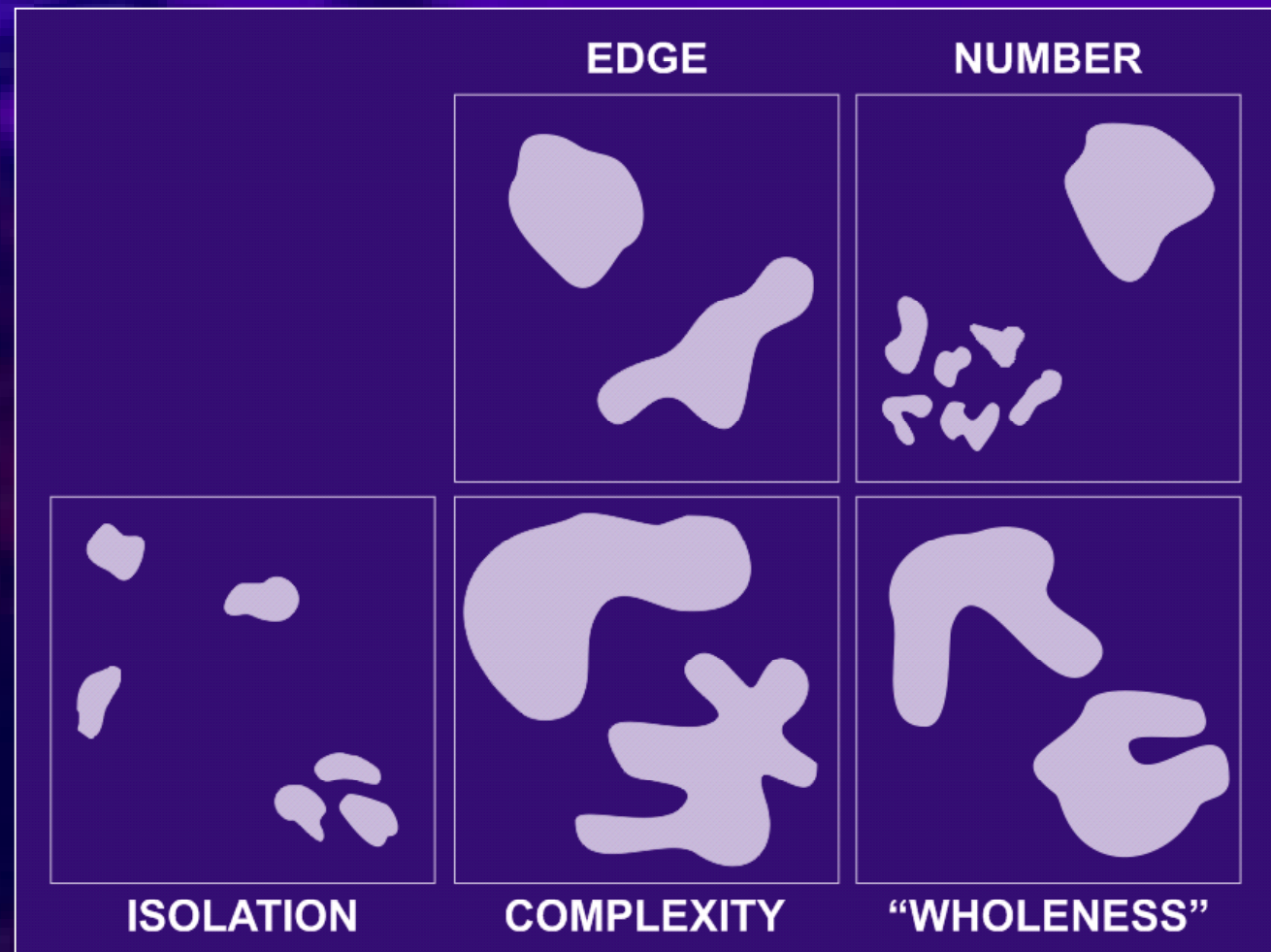
Fragmentation Key Factors (how) cont'd:

Interpreting Trends

- **Pattern to process.**
- **Thresholds and targets.**
  - **ongoing**
  - **conceptual ecosystem models**
  - **links to other E.I. Indicators / measures**

  * Must relate to minimum detectable change given classification error (Kappa), etc.

National Ecological Integrity (EI) Framework:

Biodiversity

Species richness
- change in species richness*
- numbers and extent of exotics*

Population Dynamics
- mortality/natility rates of indicator species*
- immigration/emigration of indicator species*
- population viability of indicator species*

Trophic structure
- size class distribution of all taxa
-predation levels

Process and Function

Succession/retrogression
- disturbance frequencies and size (fire. insects, flooding)*
- vegetation age class distributions*

Productivity
- Remote or by site

Decomposition
-by site

Nutrient retention
-Ca, N by site

Stressors

Human land-use patterns
- land use maps, roads densities, population densities.*

Habitat fragmentation
- patch size, inter-patch distance, forest interior*

Pollutants*
- sewage, petrochemicals etc.
- long-range transport of toxics

Climate*
- weather data
- frequency of extreme events

Other*
- park specific issues

Questions ...

Ontario Service Centre
Parks Canada Agency

Justin Quirouette (Regional GIS Specialist)
tel: (613) 998-7244
Paul Zorn (Regional Conservation Biologist)
tel: (613) 998-7248

Parks Canada Agency - Ontario Service Centre.
2630, Sheffield Road, Ottawa, ON